IMPACTS OF BACILLUS THURINGIENSIS ON NONTARGET LEPIDOPTERA AND POPULATION SUEVEYS OF LEPIDOPTERA IN POTENTIAL SPRAY AREAS

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Introduction

Microbial insecticides are preferred for suppression of forest defoliators because of their insect selectivity, high degree of environmental safety, and general public acceptance. Since 1980, Bacillus thuringiensis Berliner subsp. kurstaki, known as Bt, has been the microbial of choice for most forest spraying in the U.S. and Canada. Although Bt is a lepidopterous disease-causing agent and its relative safety has been determined for many organisms in the environment, questions frequently arise about whether or not other more-desirable moths and butterflies in the spray area may be decimated along with the target species. Further, if nontarget Lepidoptera are severely impacted by Bt sprays, we need to know how quickly and completely their populations recover postspray.

In 1993, Forest Pest Management (R6) funded a cooperative western spruce budworm suppression project on the Warm Springs Indian Reservation (WSIR) near Madras, OR. As part of that field effort, we began a ULV blacklight trapping project to evaluate the unintended impacts of Bt on nontarget Lepidoptera. Also, in recent years, planned budworm suppression programs on the Deschutes N.F. and the Willamette N.F. have been cancelled partly because of concern for possible negative impacts on the lepidopteran food resources of the Townsend's big-eared bats, a "sensitive" species known to occur on these forests. Because little information exists relative to the species or population levels of Lepidoptera resident to the central Cascades, we began a ULV blacklight survey of Lepidoptera in the Santiam corridor of the Cascades during 1993.

Objectives

Objectives for this field study are:

1. To determine first-year impacts of Bt sprays on populations of nontarget Lepidoptera in typical mixed-coniferous forests on the WSIR.

2. To determine species diversity, relative abundance, and periodicity of flight of adult Lepidoptera which may be a food source for Townsend's bib-eared bats in areas of the central Cascades Range.

Methods

Four pairs (8) of 22-watt ULV blacklight traps, powered by 12-volt auto batteries, were placed in or near planned Bt spray blocks on the WSIR in May 1993. One trap of each pair was placed approximately 0.5 km inside a spray block; the corresponding trap of that pair was at least 0.5 km outside of the spray block. Both traps were in comparable forest site/plant communities. Trap pairs were spaced at least 1.0 km (usually much more) apart. Actual trap locations are shown in Table 1.

Similarly, 8 more ULV blacklight traps were placed in a loose transect across the Santiam Pass area of the Cascades Range (Table 1). Again, traps were spaced at least 0.5 km apart, and generally further apart.

Traps were operated three (3) nights per week from about May 3 (or as soon as snow conditions permitted) until October 1, 1993. By the final week of trapping, nighttime ambient temperatures were usually below freezing, thus effectively preventing moth flight. All trap collections were kept separate by day and trap location, and transported to the lab for identification by a specialist.

In July 1993, Maret S. Pajutee, District Ecologist, Sister's Ranger District of the Deschutes N.F., conducted plant surveys of major vegetation near all trap sites, both WSIR and Santiam Pass. She used the "intuitive meander" method to compile a rough measure of plant life, identified to species (except for some grasses and sedges) within a 200 ft. radius of each trap location. Many ecologists believe that plant diversity is directly related and quite necessary to animal diversity.

RESULTS

To date, we have completed identification of all trapped Lepidoptera from the Santiam Pass area, and are now summarizing the data. About half of the collections from the Warm Springs Indian Reservation have been identified so far. About all that can be said at this time is that a large variety of nocturnal Lepidoptera have been trapped in each area, and that we think there are clear differences in moth populations between WSIR and the Santiam Pass. We will be comparing moth species diversity to plant diversity after another season of trapping, when we can be more certain of having recorded virtually all moth species present in each area. Another season of trapping results will also be necessary before we can make reasonable conclusions about the possible impacts of Bt treatments on the WSIR, simply because many species of Lepidoptera, which may have been vulnerable to sprays as feeding larvae at spray time, are univoltine and overwinter as pupae (or grown larvae). Thus, adults of these species would not be available to trap (or to be conspicuously absent from collections) until the year after spraying.

Table 2 shows that the number of moth species recorded from Santiam Pass in 1993 was close to the number trapped in the Starkey/Ukiah area over the past two years, with perhaps an increase in Geometridae and Tortricidae species. With another year's trapping we expect to add more species to the Santiam Pass total.

To summarize, after another season of trap operation, we expect to have, 1. Data necessary to draw some conclusions about the possible impacts of Bt sprays on nontarget Lepidoptera; 2. Nearly complete moth species lists for each trapping area; 3. Good information about flight periods for all trapped moths; and, 4. Useful species abundance data, especially for larger moth species which may be expected to constitute the major food sources for Townsend's big-eared bats.

Table 1. Location of ULV blacklight trapping points established in Oregon, 1993.

Trap No.	Location
Warm Springs Indian Reservation: ("A"plots were in spray area;"B"were outside)	
1A	Sec.27;T.8 S.;R.9 E.; Wasco Co.; Mill Creek lowlands
1B	Sec.23;T.8 S.;R.9 E.; Wasco co.; Mill Creek lowlands
2A	Sec. 7;T.9 S.;R.9 E.; Jefferson Co.; Boulder Creek drainage
2B	Sec. 8;T.9 S.;R.9 E.; Jefferson Co.; Boulder Creek drainage
3A	Sec.26;T.10 S.;R.9 E.; Jefferson Co.; Camp Creek drainage
3B	Sec.24;T.10 S.;R.9 E.; Jefferson Co.; Camp Creek drainage
4A	Sec.27;T.11 S.;R.9 E.; Jefferson Co.; Mariel Creek drainage
4B	Sec.26;T.11 S.;R.9 E.; Jefferson Co.; Mariel Creek drainage
Santiam Pass, Cascades Range:	
1A	Sec.29;T.13 S.;R.7 E.; Linn Co.; Lava fields
1B	Sec.26;T.13 S.;R.7 E.; Linn Co.; Lava fields
2A	Sec.21;T.13 S.;R.7.5 E.; Linn Co.; Lost Lake marshland
2B	Sec.22;T.13 S.;R.7.5 E.; Linn Co.; Lost Lake creek
3A	Sec.19;T.13 S.;R.8 E.; Deschutes Co.; Blue Lake creek drainage
4A	Sec.32;T.13 S.;R.8 E.; Deschutes Co.; Link Lake creek drainage
4B	Sec.29;T.13 S.;R.8 E.; Deschutes Co.; Island Lake creek drainage
5A	Sec.23;T.13 S.;R.8 E.; Deschutes Co.; Suttle Lake creek drainage

Table 2. Comparison of species abundance in trap collections between 1992 and 1993 in Starkey-Ukiah (St/Uk) area, and in Santiam Pass (Sant) area

	NUMBER OF SPECIES [1]					
	St/Uk		Sant		St/Uk		Sant
Family	1992	1993	1993	Family	1992	1993	1993
Alucitidae	1	0	0	Oecophoridae	2	2	3
Arctiidae	7	6	9	Plutellidae	1	1	1
Geometridae	93	87	121	Pterophoridae	1	1	1
Hepialidae	2	0	1	Pyralidae	33	28	29
Incurvariidae	0	1	1	Saturniidae	2	2	2
Lasiocampidae	4	4	4	Sphingidae	6	4	4
Lymantriidae	1	0	1	Thyratiridae	3	2	3
Noctuidae	212	174	189	Tortricidae	14	17	22
Notodontidae	3	2	5				
TOTAL:					385	331	396

1. Data indicate the total number of species trapped by family in 1992 and 1993. In Starkey/ Ukiah trapping areas, 1993 data reflects both new species not recorded for 1992, and some reductions where some species caught in 1992 were not again trapped in 1993. Thus, in some families, the total number of species caught in 1992 plus 1993 would be larger than indicated by either column number.

1994 BUDGET

October 1, 1993 to September 30, 1994

Personnel	Estimated time	Estimated salary	Fringe Benefit costs	Total
Res. Entomol.	26 weeks	---	---	---
Biol. Aides 2; GS-3	22 weeks	12320	924	13244
Lab Tech. (Half time) 1; GS-9	26 weeks	8310	1108	9418
				22662

Equipment and Supplies

1000 DDVP strips	1000
Lab supplies	500
	1500

Travel

2 Pickup trucks (4X4), (5 mos.; rent & mileage)	4000
Per diem (1- 20 weeks; 2- 5 weeks each)	7200
	11200

Miscellaneous

Moth identification	4000
Publication, meetings	1000
	5000

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GRAND TOTAL: $ 40362